

Using Synergistic Remediation to Promote the Risk-Based Cleanup of Chlorinated Ethenes at a Historical Train Derailment Site

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Synergistic Remediation

What do we mean by “synergistic remediation”?

A remediation approach designed to create a result that exceeds the anticipated “sum of its parts”



Livingston Train Derailment

- One of the most significant environmental disasters in Louisiana history (1982)
- 30 year pump and treat
- With EZVI, attained all remedial goals in about a year

History



- 1982
- More than 20 Railcars involved
- Burned for 2 weeks
- Slurry Wall/ Pump & Treat System
- Sumps in 3 excavated pits
- PCE DNAPL remained

Derailed Cars, Contents, and Product Status

Chemicals released included:

- Vinyl chloride
- Styrene
- **Tetrachloroethene**
- Ethylene Glycol
- Hydrofluorosilic Acid
- Phosphoric Acid
- Lubricating Oil
- Sodium hydroxide
- Toluene Diisocyanate

Remediation History

- Initial emergency response – 1 month
- Dig and Haul & Slurry wall – 1-2 years
- Pump and treat – 30 years

Site - Current



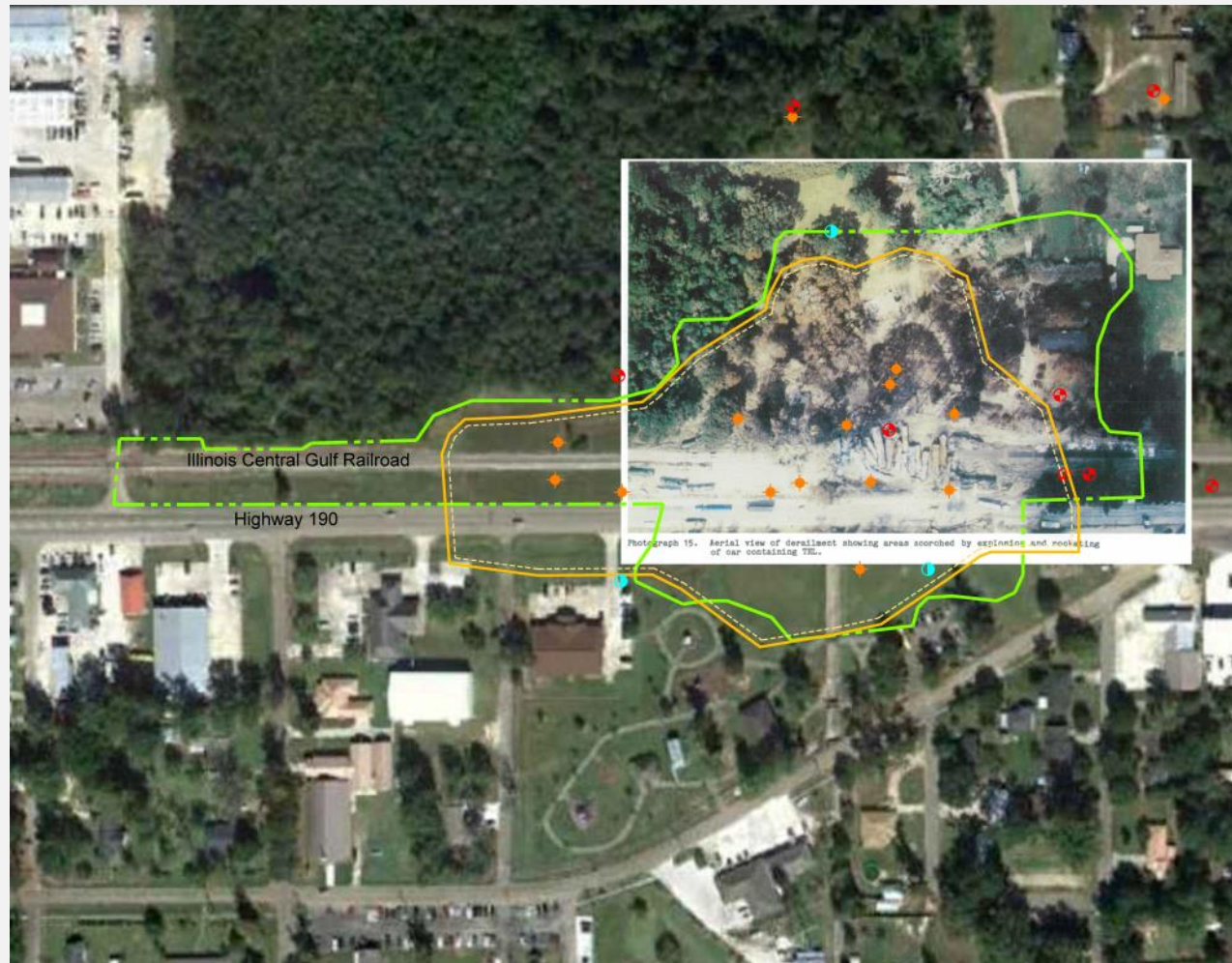
Site – 1 Week Post Incident



LEGEND

- Location of Slurry Wall
- ± 10' Offset from Slurry Wall
- - - Historical Derailment Site Boundary

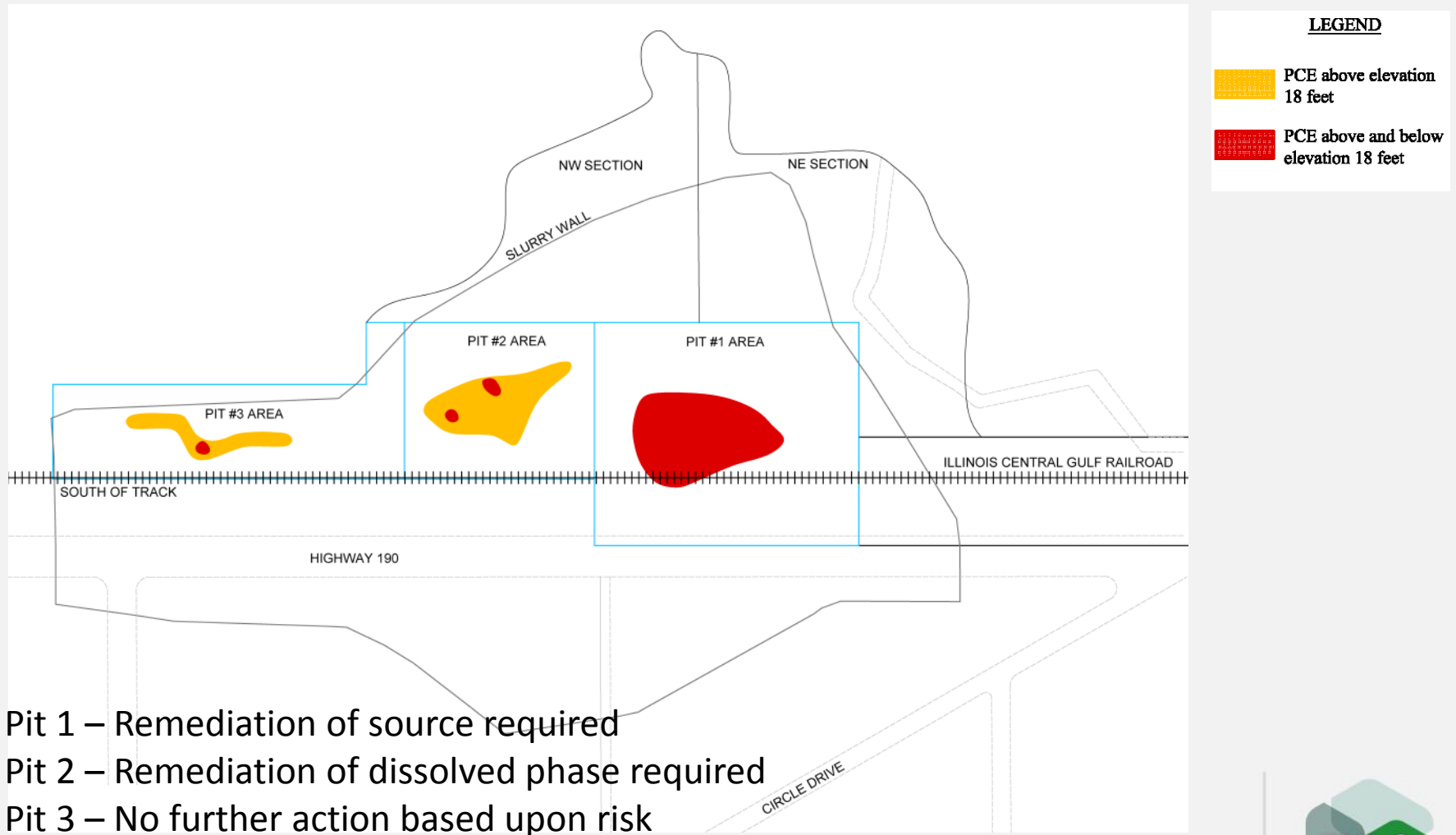
Site Map



LEGEND

- Location of Slurry Wall
- ± 10' Offset from Slurry Wall
- - - Historical Derailment Site Boundary
- Monitoring Well - 40' Deep
- Monitoring Well - 10' Deep
- Monitoring Well - 100' Deep

Historical Extent of PCE



Pit Area #1

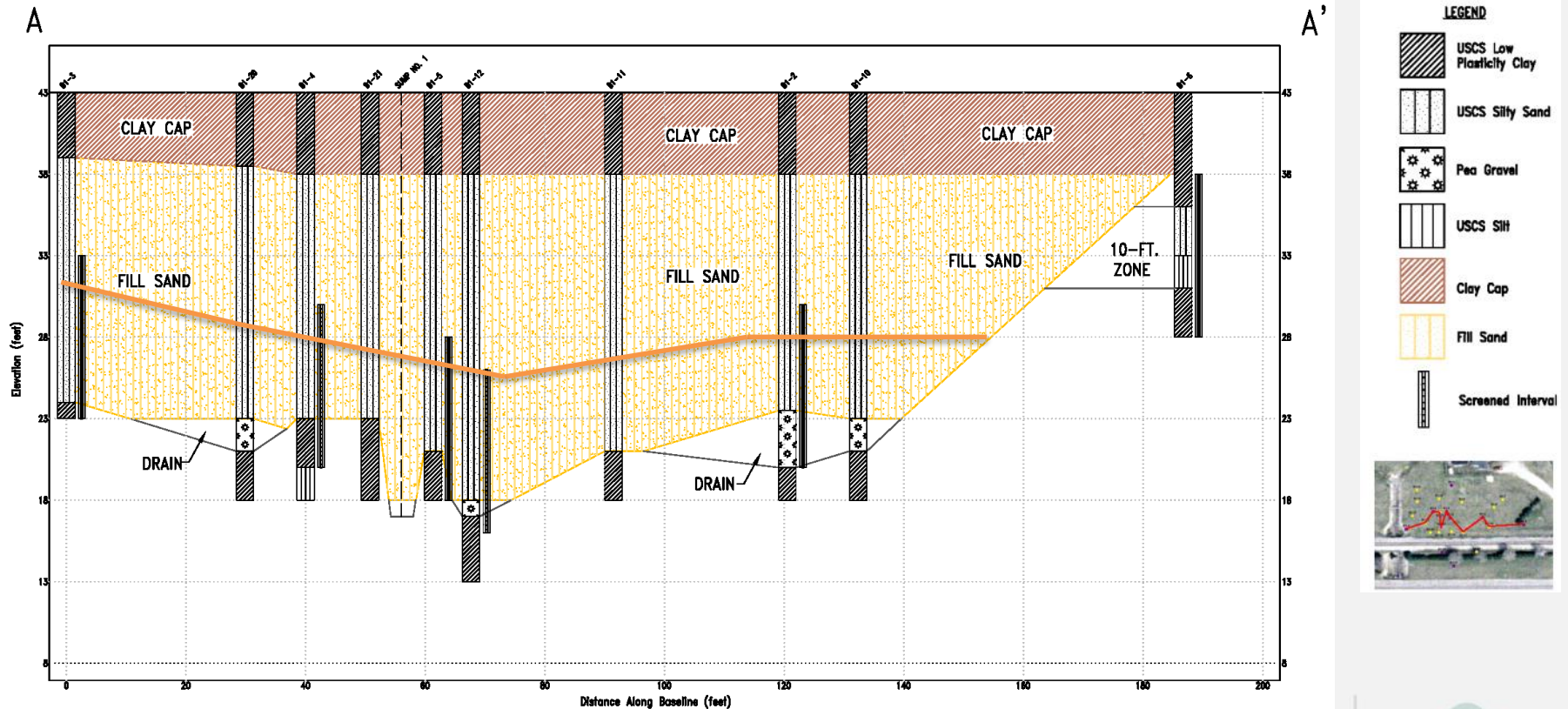
Groundwater Screening AOI



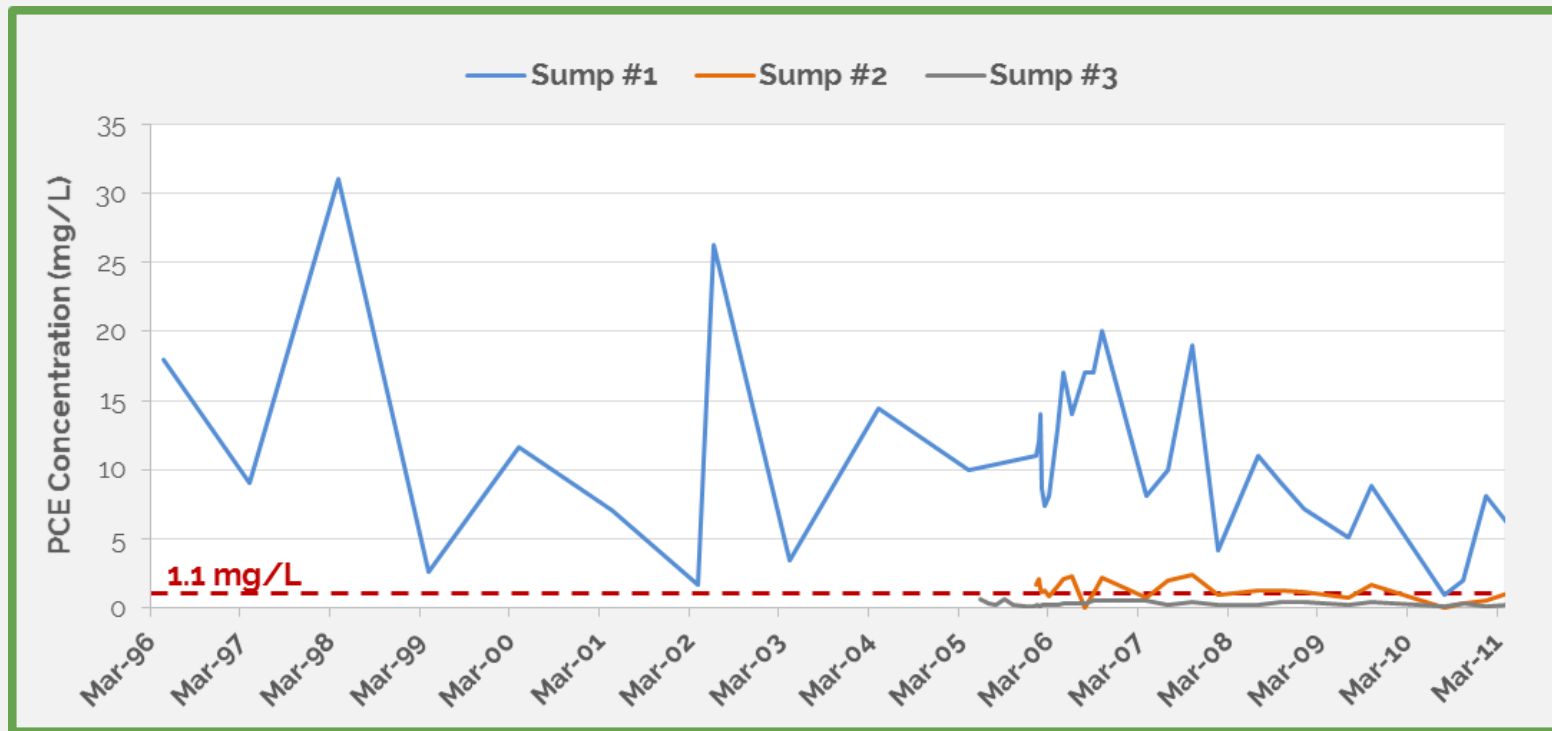
Legend

- Temporary Well Location
- Boring Location
- 10-Foot Monitoring Well
- ▲ Sump
- ⊗ Temporary Well - inadequate yield for sample
- ⊗ Boring Location - no water encountered
- 0.005 mg/L
GW_{SS} PCE = 0.005 mg/L

Pit Area #1 Cross Section



Historical PCE Concentrations Sumps 1, 2, & 3



EZVI

What is EZVI?

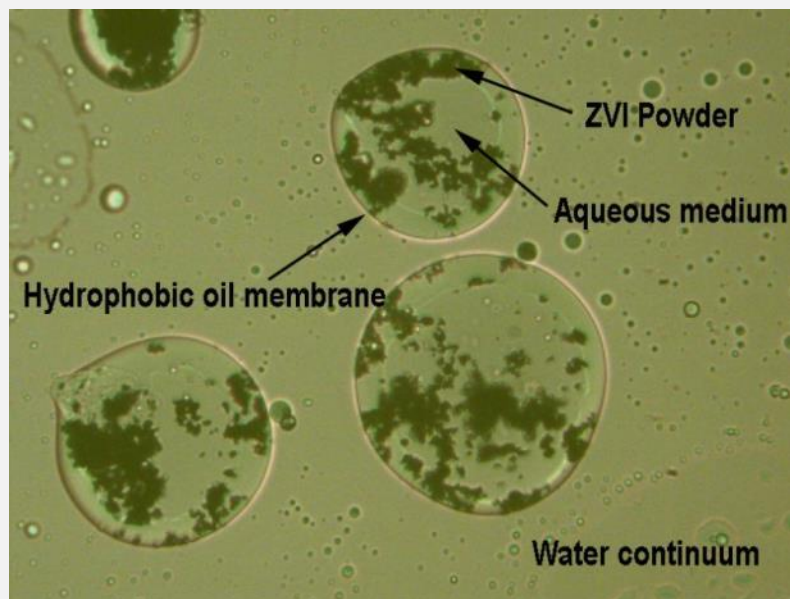
- Developed and patented by NASA as a DNAPL remediation technology
- Nano/micrometer ZVI within a
 - surfactant-stabilized,
 - biodegradable,
 - water-in-oil emulsion



EZVI

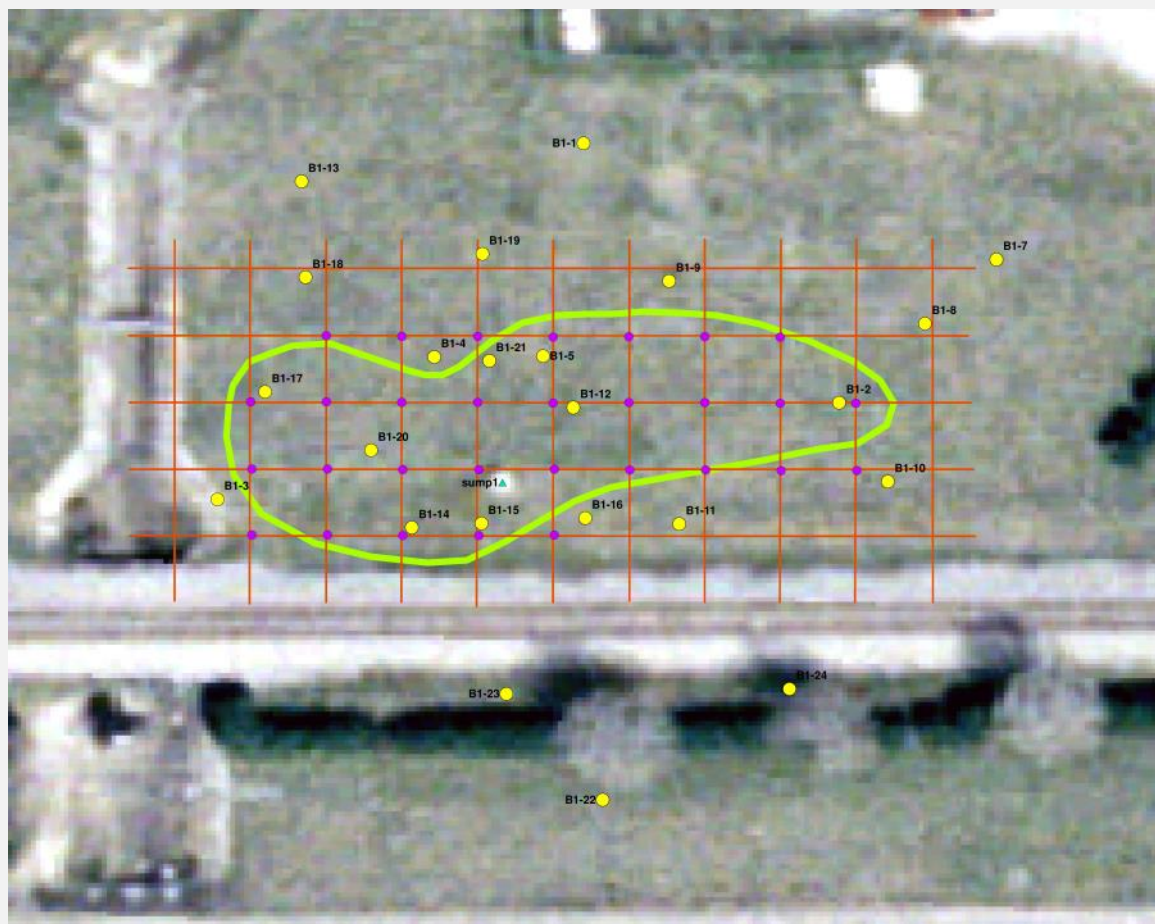
How does it work?

1. Sequestration



2. Reductive Dehalogenation (abiotic & biotic)

Pit #1 – EZVI, Oil and Microbes



Legend

- Former Boring Locations
- ▲ Sump
- Injection Locations
- 15' Centers
- Area of Investigation

Pit #2 – Oil and Microbes

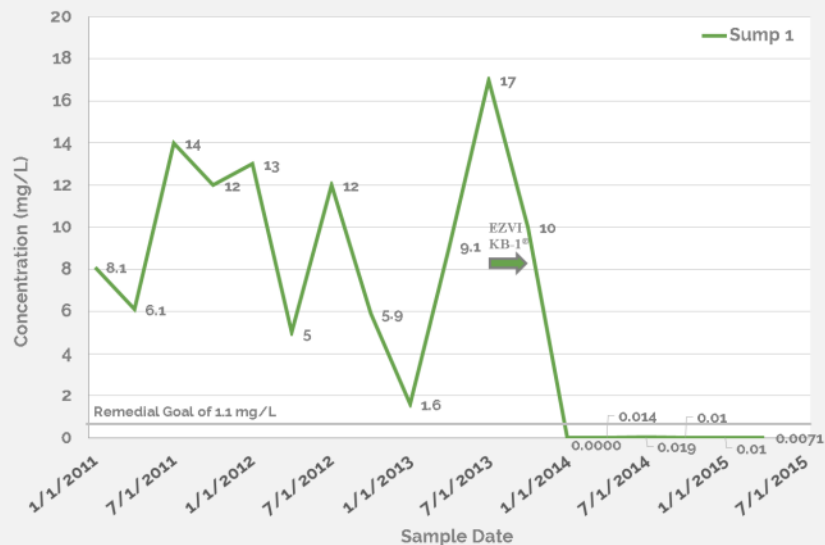


Legend

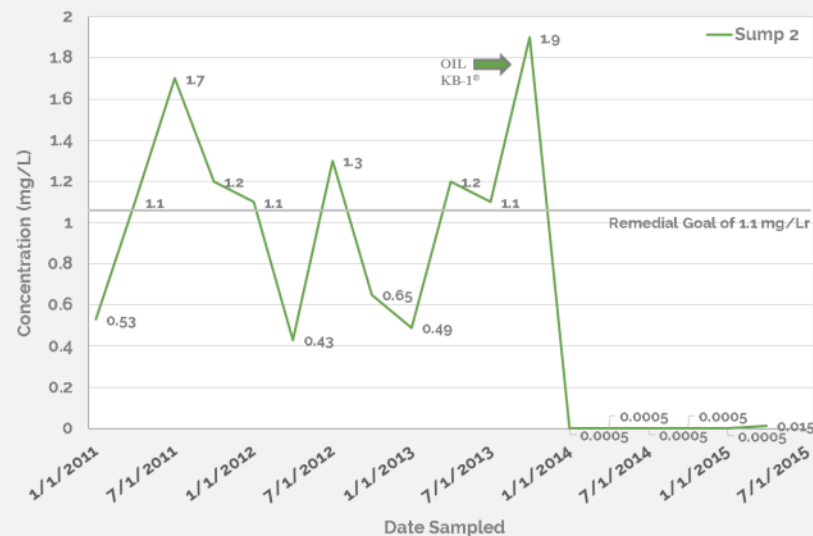
- 40 Foot Diameter Injection Ring
- Injection Location (21' Spacing)
- Former Temporary Well Location
- ▲ Sump 2

Injection Results

SUMP 1 - PCE CONCENTRATIONS



SUMP 2 - PCE CONCENTRATIONS



Value of Synergistic Remediation

Only \$3.5M left in trust fund. Spent \$1.7M. \$1.8M left for community benefit.

- Projected Base Cost for 30 more years of P&T with monitoring: \$5.4 M
- Actual by TEA spent: \$1.7 M
- Net saved **\$3.7 M**

What's Closure Worth?

- Emergency response\$\$\$\$\$
- Dig and Haul\$\$\$\$\$
- Slurry Wall.....\$\$\$\$\$
- Pump and treat.....\$\$\$\$
- EZVI & RECAP.....\$\$
- Site Closure.....Priceless!



HIGH 68 LOW 46
FORECAST, MORE ON 8B

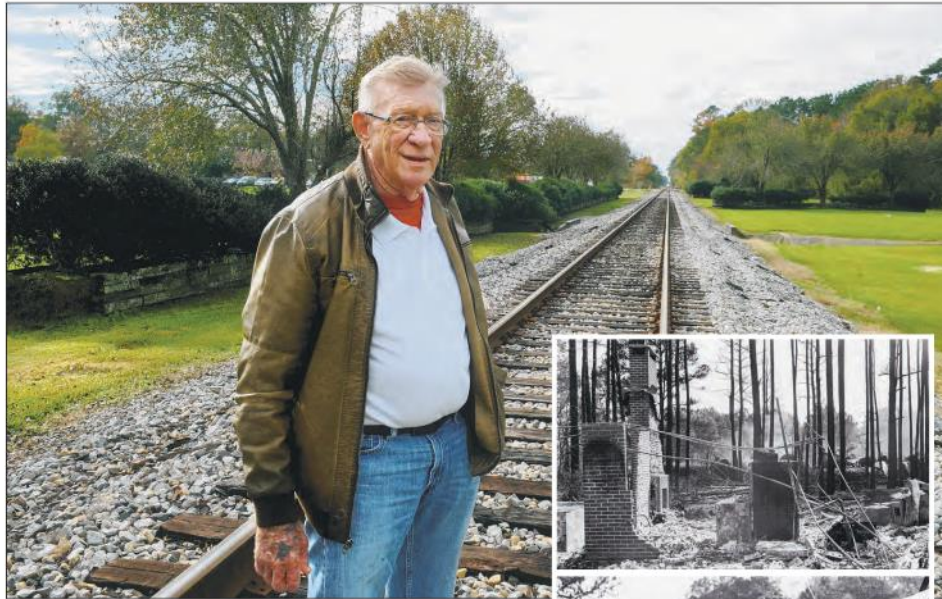
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91st year, No. 159

Livingston cleanup nears end in '82 train derailment



Advocate staff photo by PATRICK DENNIS

Livingston Mayor Derral Jones talks about the 1982 train derailment that happened in the center of town and had chemical tanker cars burning for 14 days. Jones, the fire chief then, said the containment site is finally being shut down after 33 years of cleanup and monitoring.

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